

Fostering Collaborative Redesign of Work Practice: Challenges for Tools Supporting Reflection at Work

Michael Prilla, Viktoria Pammer and Birgit Krogstie

Abstract Reflection is a well-known mechanism to learn from experience. Often, it has been investigated from an educational viewpoint or as a formalised procedure such as in project debriefing. Based on an analysis of three case studies, we show that collaborative reflection is much more embedded in daily work and that it supports collaborative, bottom-up redesign of work. We found that processes of work redesign alternate between individual and collaborative reflection and identified reasons for collaborative reflection as well as criteria for selecting reflection partners. We also identified perspective exchange, attribution and (re-)appraisal of past situations to be decisive for collaborative reflection and how it supports finding adequate levels of work redesign and partners needed to implement change. From this, we describe five themes for the design of support for collaborative reflection as a means for work redesign.

Introduction

Reflection on work is a typical mechanism of (implicit) learning in the workplace (Boud et al. 1985; Eraut 2004; Kolb and Fry 1975; Schön 1983): People think about whether they acted appropriately in a certain situation or whether their cooperation with others runs smoothly and how things can be improved. Reflection can be understood as re-evaluation of experience(s) for the purpose of guiding

M. Prilla (✉)
Ruhr-University of Bochum, Bochum, Germany
e-mail: michael.prilla@rub.de

V. Pammer
TU Graz and Know Center, Graz, Austria
e-mail: vpammer@know-center.at

B. Krogstie
Norwegian University of Science and Technology, Trondheim, Norway
e-mail: birgitkr@idi.ntnu.no

future behaviour (Boud et al. 1985). It helps people make sense of an experience, handle difficult emotions, or find a way of solving a concrete problem, by transforming experience into knowledge applicable for daily work as part of a learning cycle (Kimmerle et al. 2010; Stahl 2000). Reflection thus combines “codified knowledge” and “cultural knowledge” (Eraut 2004), giving people the chance to learn from past work and to *redesign future work*—the latter outcome transcends approaches of enabling people to actively shape their work as currently known in CSCW and will be the focus of this paper.

Reflection has a strong social dimension (Boud et al. 2006; Hoyrup 2004) and is often accomplished collaboratively by a team or working unit. *Collaborative reflection* means that people reflect together by exchanging (similar) experiences, discussing them and deriving insights together. Accordingly, we can understand collaborative reflection as external, communicative process, in contrast to individual reflection which is an internal, cognitive process. Collaborative reflection then transcends individual reflection, as it enables participants to learn from each other and to craft new knowledge from shared experiences (Daudelin 1996; Hoyrup 2004). A lot of work on collaborative reflection investigates singular events such as project (Kerth 2001), but little is known about other processes of collaborative reflection and how technology can be designed to support reflection through which people can influence their work environment.

We investigated processes of collaborative reflection in three different cases (hospital, IT consulting, social care). We found that collaborative reflection may lead to a *redesign of work* that is *triggered and implemented by workers* rather than experts, managers or other superordinate roles. This means that workers identify discrepancies or difficult situations during work, derive a proper understanding of the experience and on that basis implement changes in the work practice on their own. Such democratization of work design may speed up change processes in organizations and raise the satisfaction of employees. Within this paper, we take a deeper look on the question of how to support processes of collaborative reflection that finally lead to redesigning work. This work is especially relevant for the CSCW community as it shows how by collaborative reflection people can bypass hierarchical barriers and redesign group work on their own. As collaborative reflection is a frequent, yet hardly investigated mechanism, there is a need to understand it better to tap on this potential.

In what follows, we describe the three case studies on which this work is based, including examples of collaborative reflection from the cases. We then describe characteristics of collaborative reflection by relating foundational work on reflection to our examples. Analyzing the cases, we show how collaborative reflection leads to work redesign and that it is based on an interplay of individual and collaborative reflection sessions. This leads to questions of what triggers collaborative reflection, what mechanisms happen inside collaborative reflection, and how results are created collaboratively. We answer these questions by analyzing the cases more deeply, identifying support needs for collaborative reflection. On this basis we derive *five themes for the design of tool support* for collaborative reflection as a means for work redesign.

Related Work

Collaborative reflection is close to other concepts in CSCW. We will briefly discuss sensemaking, collective mind, collaborative problem solving and decision support according to their slight, yet decisive differences to reflection.

Sensemaking (Weick 1995) has a clear relation to reflection in that it is a process of understanding previous events better. Weick (1995) describes it as a process of creating clearer picture of what has happened concerning a particular event in order to “rationalize what people are doing”. While it may also contain asking about what new insights may mean in terms of future actions, reflection has a much clearer focus on the future than sensemaking, by stressing “outcomes”. *Collective mind theory* (Weick and Roberts 1993) goes beyond sensemaking and describes a conscious process of conversation, which is close to communication during reflection, and recapitulation, which contains replaying and reanalyzing important events (Crowston and Kammerer 1998). The latter, however, is a process of building a shared identity rather than deriving change for the future and makes it a routinized group building process rather than a practice of *work redesign*, as which we understand collaborative reflection at work here.

Reflection in groups typically involves considering alternatives and agreeing on outcomes, i.e. it incorporates decision processes. (Group) *Decision Support Systems (DSS)*, which can be understood as “interactive computer-based systems that help people use computer communications (...) to solve problems and make decisions” (Power and Sharda 2009), are about decision making in teams. Their focus, even for distributed DSS (Gray et al. 2011), is on the decision making task and not on other aspects of collaboration (Dennis et al. 1988) or on reflection.

Collaborative problem solving (Roschelle and Teasley 1995) describes a process of constructing and maintaining a joint problem space and, by acting and communicating, learning together how to solve a problem. In such processes there is, however, a tendency to focus on information that is shared among all its members from the start, which is called the “shared information bias” (Baker 2010). Collaborative reflection, in which group members share different experiences, may overcome this, as shared information is on the type of experience rather than on particular events.

Collaborative reflection differs from these concepts in its clear focus on the re-assessment of experiences and creating outcomes that affect future work. While both might be relevant for processes such as problem solving, sensemaking, creating collective mind or supporting decisions, the emphasis on going back to experiences, re-evaluating them and drawing conclusions for the future makes collaborative reflection a unique phenomenon that is deeply embedded into daily work. Therefore, it may benefit from solutions for any of the concepts mentioned above, but a thorough analysis and understanding of its occurrence and needs in practice is needed first.

Reflection in Practice: Three Cases

The findings in this paper are based on investigations of three cases, including a hospital, a consulting company and care homes for elderly people.

The Cases

Case 1: Reflection in a hospital

In Case 1, we investigated a ward in a German hospital in which acute stroke patients are treated. Due to the demands of this work, the staff is highly trained. Their primary motivation is a desire to help people by providing good care to improve the quality of patients' lives. Work is organized in shifts: physicians work in two shifts covering days and nights, nurses work in shifts in the morning, the afternoon and the night. Between shifts, handovers are done within and between these two professional groups. Regular meetings are held bi-weekly to discuss issues on the ward. Work in the ward is constrained by time pressure and emotional stress. Often, due to time pressure, mandatory documentation is done after shifts to guarantee that it does not interfere with caring properly for patients. Emotional stress results from work with patients who are unable to articulate what they need or who are getting gradually worse. In addition, physicians need to make decisions affecting patients' lives, and they need to talk to relatives of the patients, which often includes bringing bad news. Supervision and mutual help are accordingly considered important among staff.

We observed a physician and a nurse for two days each and conducted four interviews with nurses and physicians. We conducted focus group workshops with four nurses and three physicians to identify support needs and options.

Case 2: Reflection in IT Consulting

The consulting case study was carried out at a German IT company selling and personalizing customer relationship management software to help analysing and optimising the marketing, sales and service processes of their customers. The company has about 60 employees, most of them based in the headquarters. Many meetings with customers are held at the customers' sites, which requires internal preparation and post-processing. Daily work is heavily focused on customers' needs. Therefore, consultants need a high degree of flexibility in their work. We found that consulting and sales thus involves a high degree of reflection on interaction with the customer. As a consequence, knowledge management and sharing is considered to be a major challenge in this organization. Consultants mainly work in small teams of two to three people and often talk to each other about their work. We conducted interviews with five consultants and observed two consultants for 2 days each.

Case 3: Reflection in social care

The care home case study was carried out in two nursing homes in the UK (referred to as homes A and B). A growing challenge for both homes is the higher proportion of elderly residents suffering from dementia. These people often show what is called ‘challenging behaviour’, during which they react aggressively to unfamiliar surroundings or events. This requires a lot of reflection on the side of the caregivers, as there is no one-size-fits-all solution when dealing with people suffering from dementia. To deal with them one needs to understand the individual and their complex life history. Most of the care staff, except for the registered nurses, who are responsible for medical issues, are not educated to a degree level, and have only been trained for at most a few weeks. In home A, we observed meetings during two days and interviewed four caregivers. In home B, we interviewed three caregivers and observed one and a half day of work practice.

Methodology

The analysis of the three case studies uses material gathered during field visits, including work observations and interviews. For each case, two researchers followed two staff members for two days each, observing their daily practice with a special emphasis on reflection, taking notes on their observations. For case 3 (social care), in home B different members of staff and their tasks were observed during one and a half day. In addition, semi-structured interviews were conducted with staff in all cases, asking about reflection in practice and related aspects such as learning, knowledge transfer and communication in their work environment. The interviews were audiotaped and transcribed. In Case 1, also focus groups were created and interviewed on their needs and current habits of reflection.

The resulting material was analysed in an approach aligned to Grounded Theory (Strauss and Corbin 1998). Additionally, we used indicators for reflection as described by van Woerkom and Croon (2008) during analysis to identify reflection in the material and to differentiate it from other occurrences of thinking about past events. The combination of interviews and work observations provided a holistic overview of reflection in the cases, as interviews provided more general information on needs and habits than what could be seen from the observation. Conversely, the observations provided better insights into the specific work environment and reflection practice than could be inferred from the interviews.

Reflection in the Cases by Example

To illustrate our understanding of occurrences of reflection, we provide examples of successful reflection from the three cases below. The examples serve as proxies

for many others and will be used in the paper to illustrate our findings from an analysis of the three cases and the need for support in less optimal cases.

Example 1: Starting the alarm procedure in a hospital ward

During our observation, a patient with an acute stroke and in very bad condition was admitted to the emergency room of the ward. The responsible physician realized that this was a very critical case. The standard procedure is to start an internal alarm, which causes the head physician and an emergency team to immediately come to the ward. The present nurse tried to start the alarm with her internal telephone, as there was no alarm button in the room. However, the alarm did not go off and the helpers did not arrive in the next minutes. The nurse then called the head physician and the emergency team directly, and they came to the emergency room and took care of the patient.

After this situation, the nurse reflected on the problem by repeatedly going through the procedure he had applied in the emergency room. He did not find a reason for the problem and therefore asked the head nurse to reflect on the issue together. She had had a similar experience, and together they realized that using the telephone for the emergency procedure as it was described in the hospital's quality manual was too complicated in emergency situations. After this, the head nurse recalled other similar situations she had been in and thought about the resolutions she had come up with then. To clarify the issue, she finally added it to the agenda for the upcoming ward meeting and asked the nurse who had experienced the problem to explain it to the others, including the reason they had come up with. Some of the other nurses present reported similar problems. As a result of sharing the experiences, the nurses agreed to practice essential procedures more often and to change the telephone emergency procedure. As the latter could not be implemented by the nurses, but is subject to hospital-wide standards, the head nurse agreed to talk to the responsible quality manager to change the procedure.

Example 2: Losing sales pitches in an IT Consulting Company

After a time of success, some sales consultants in the company realized that they were losing more pitches than they used to. Each consultant had thought about this, but nobody had an idea of how to change the situation. In the monthly meeting of sales consultants, in which they usually iterate through current activities, one consultant mentioned this problem. The other consultants reported similar impressions. They focused the meeting on pitches that had been lost recently and started to reflect on what had happened there to find reasons for the losses. Going through the experiences, they found that in most cases the critical issue had been the customer asking for an interactive demo system. The company usually did not provide customers with demo systems, but invited them to the site of a reference customer to show them an operational system. The consultants reported that customers had often been dissatisfied with the lacking demo system, as competitors had provided demo systems, and that they had struggled with this dissatisfaction during the remainder of the pitch. They decided that from now on they would have a demo system for customers. The head consultant agreed to talk

to the IT department in order to set up such a demo system. He also reported this to the management, who agreed to change the company standards to include demo systems in the sales process.

Example 3: Challenging behaviour in a care home

In home A, caregivers often discuss challenging behaviour of residents, possible reasons for such behaviour and how to deal with it. This is done in what is called “reflective meetings”, in which a senior caregiver meets with other staff and asks them if there is something bothering them or worth discussing for other reasons. In one of these meetings a young caregiver, who had started work only weeks before, reported a problem: A resident of the care home had approached him multiple times, asking when she would be allowed to leave the care for her own home. The young man was very sad for her and because he did not know what to tell her. Some of the other, more experienced caregivers reported similar experiences, and told him that this also affected them much when they were younger and proposed what could have caused the lady’s behaviour. They also described how they had dealt with these situations and the emotions caused by them. This gave the junior caregiver alternative ways to deal with the situation and showed him that the problem was relevant not only to him. In addition, the group decided that the best way to react in such situations was to be honest and tell the residents that they are in a care home and that this was their permanent home. They agreed that this should be the standard procedure for the future.

(Collaborative) Reflection in the Cases

Below, we relate the examples from the cases to insights and terminology from prior work on reflection that influences our research.

The Reflection Process

Our understanding of reflection is closely aligned to that of Boud et al. (1985), who identify three main steps in the reflective learning process.

- (1) **Going back to experiences** that happened in the past,
- (2) **re-evaluating and understanding these experiences** in the light of current knowledge or experiences and
- (3) **deriving insights for future behaviour** from this assessment.

The steps are explained in Table 1 by referring to the examples given above.

Boud et al. (1985) emphasise the *non-linear structure* of reflection in practice. In contrast to other models of learning from experience (e.g., Kolb and Fry 1975),

Table 1 Reflection steps in the model of Boud et al. (1985) with examples from the cases

Case/step	Going back to experiences	Re-evaluating and understanding exp.	Deriving insights for future work
Case 1: Hospital	<i>Individual:</i> Thinking about the problem <i>Collaborative:</i> Exchanging experiences on the emergency procedure	Realizing that the stressful situation afforded too much attention to care and that the alarm procedure was too complicated	Agreeing to practice standard procedures more often and to modify the emergency procedure
Case 2: Consulting	<i>Individual:</i> Thinking about lost pitches <i>Collaborative:</i> Exchanging reports on pitches	Realizing that many similar experiences had in common that the client asked for a demo system	Agreeing to add demo systems to the standard procedure for customer visits
Case 3: Social care	<i>Individual:</i> Thinking about dealing with the resident <i>Collaborative:</i> Talking about similar situations	Discussing previous solutions of and understanding that the truth was the best option	Changing the way to talk to the old lady and agreeing on a standard procedure for this

they include explicit loopbacks between the steps. They also focus on the *process* of reflection rather than reflection as a mind-set (e.g., Reynolds 1999) or professional attitude (e.g., Schön 1983). This helps to identify reflection in practice, differentiate it from other ways to think about past (work) events (see related work) and to support reflection appropriately. The model by Boud et al. should be considered a *blueprint* and not as a normative process, as formalizing the reflection process too much may inhibit reflection as it evolves in practice, and may also lead to resistance among reflection participants (Boud et al. 2006).

Reflection Sessions

Reflection takes place in *sessions*, “a time-limited activity of reflecting” (Krogstie et al. 2012) distinguished by a specific time span, a place, a particular set of participants and whether it is spontaneous or planned. It may take place “in action”, being inextricably linked to work activity, or “on action”, in which case the reflection session can be arbitrarily separated in its characteristics from work activities (Schön 1983). Reflection on the same topic may span several sessions

such as in the example from the hospital, in which at first the two nurses had a reflection session before the head nurse started another session in the meeting.

Collaborative Reflection as a Means to Redesign Work Practice

In the cases, successful collaborative reflection at work was often a means to redesign work processes. This highlights new opportunities for work redesign: While this is often left to experts and superiors, *reflection offers the opportunity to enable workers to redesign their work and implement this change.*

Redesigning Work

Redesigning work means questioning and changing norms, procedures and their underlying rationales and can thus be understood as double-loop learning as explained by Argyris and Schön (1978). Understanding collaborative reflection as a means to redesign work, we can also see workers reflecting collaboratively as a design community in the (broad) sense of “being concerned with ‘how things ought to be’” (Fischer and Ostwald 2003).

In the case studies, we found many situations in which reflection helped a group to analyse the structure and rationales of (collaborative) work and identify potential improvements as well as people needed to implement them. The group of nurses in example 1 realized that in addition to changes in the procedure for the alarm (implementation that would need approval by management), they needed to intensify their training on the ward (implementation feasible within the team). In the case of the care home (example 3), the group did not only help the junior caregiver to deal with his emotions, but also decided that being honest to residents should be a leading paradigm in similar situations from now on, thus transforming what had started as peer help to a collaboratively achieved redesign of work for the whole group. The consultants in example 2 agreed to use a demo system in future pitches, adding this to the best practice procedure of their company.

Overall, our observations indicate that collaborative reflection can create a dynamic in which a *group of workers becomes enabled to redesign work, thereby creating a change within the organization.* This is in line with Engeström et al. (1996), who also show how data on past experiences can support the change of work practices. However, extending this and other approaches, it also shows that such work redesign is not bound to scheduled sessions, but happens continuously and ubiquitously through reflection. In addition, it shows that in some cases, the group is itself able to implement changes, while in other cases the group needs to enlist additional actors in order to implement the solution.

Back and Forth Between Individual and Collaborative Reflection

The road to collaborative redesign of work can be regarded as a continuous interplay of individual and collaborative reflection sessions (see also Engeström et al. (1996)). Each of our examples contains sessions in which individuals reflect alone and sessions in which they reflect together with others. These sessions build on each other, as the social care case (example 3) shows: The caregiver had reflected on his own before he told his colleagues about it (individual). Hearing his account, the colleagues recalled similar experiences and reflected on them (collaborative reflection). The consultants in example 2 had reflected on lost pitches (individual) before addressing the issue in the meeting and discussing similar experiences (collaborative reflection). Collaborative reflection in this case was amplified by the earlier reflection as participants could bring their insights into the discussion. The process of an individual seeking the assistance of others is typical for dealing with negative experiences. It may also get more complex: In example 1, the nurse had approached the head nurse for collaborative reflection. After this, the head nurse started to reflect on her experiences with the problem (individual) and decided to bring this topic up for collaborative reflection of all nurses in their next meeting. These observations show how processes of reflection may take multiple iterations between individual and collaborative reflection and how these loops amplify the created outcomes (see also Fig. 1).

Towards Designing Technology that Supports the Reflective Process of Work Redesign: Research Questions

Our analysis shows that collaborative reflection can contribute to work redesign and that this redesign relies on loops of collaborative and individual reflection. The redesign process is often started by an individual approaching others with the

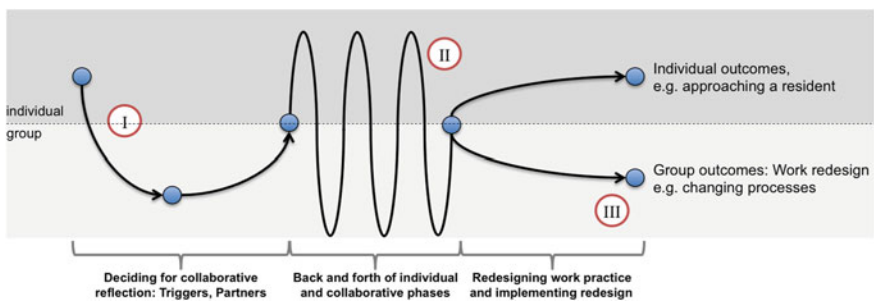


Fig. 1 The process of collaborative reflection for redesigning work

purpose of reflecting together, by sharing experiences (e.g., on lost pitches) or asking for experiences with similar issues (e.g., problems with the alarm procedures). It results in outcomes for the individual or the group (Fig. 1).

In the multitude of situations we observed to run less smoothly than the examples used in this paper, tools could support people to reflect together by providing data on work and the perspectives of others on this data as a basis for reflection (Knipfer et al. 2011). The challenge for tools is then to enable transitions between individual and collaborative reflection, to help people identify needs for redesign and to support the implementation of insights gained through reflection. Given the usual course of reflection as described above, designing such support needs answers to the following research questions:

- (1) **Initializing collaborative reflection:** Why and how do people engage in collaborative reflection? What motivates them to share their observations and solutions? (no. I in Fig. 1)
- (2) **Reflecting collaboratively:** What are the particular characteristics of collaborative reflection and what is necessary to create solutions for redesigning work? (no. II in Fig. 1)
- (3) **Outcomes of collaborative reflection:** How do the reflection actors move from collaborative reflection to redesigning work? What kind of work can be redesigned? (no. III in Fig. 1)

Understanding Collaborative Reflection

Below, we analyze our cases driven by the three research questions.

Initializing Collaborative Reflection: Triggers and Partners

In practice, collaborative reflection is often initialized by an individual approaching others and articulating her experiences. But what actually causes the individual to approach colleagues, that is, what triggers collaborative reflection? Among the scarce literature on such triggers, van Woerkom and Croon (2008) only list typical situations in which collaborative reflection is initiated such as asking for feedback or questioning norms, but do not investigate the underlying reasons why people ask for feedback or question norms. Our cases provide more insights: In the case of the failed emergency alarm (example 1), the nurse wanted *clarification* on the reasons for the problem and approached the head nurse. The head nurse went from individual reflection to a group session of reflection because she wanted the whole group to become *aware* of the problem and *solve it together*—she knew that the chances of finding a solution and implementing it would be higher if the group was involved. The consultant from example 2 speaking up in

the meeting initially wanted to *get feedback* on this problem. In the care home example, the junior caregiver was *seeking help and advice* in a situation that he felt bad about. Finally, although we were not able to observe this, in examples 1 and 2 people who were *needed for implementing the identified solutions* (the change in the procedure and the demo system) were contacted. This can be regarded as another trigger for collaborative reflection.

Once individuals realise that they want to reflect with others, there is a question of whom to approach. Just like reasons for choosing communication partners are diverse (Sykes 1983), choosing reflection partners is not straightforward, but depends on the problem to be reflected on and the purpose of reflection. Individuals may approach people with *more competence or experience* to get advice from them (as in example 1). This may not necessarily lead to collaborative reflection if the answer is known by the more experienced partner, but this is often not the case and collaborative reflection is initialised (as in example 1). In other cases, individuals approach people who can *give emotional support* in addition to advice (trusted peers or experts, as in example 3). We also observed the choice of *people with less experience or awareness of a problem* as reflection partners. Here, the rationale was to make others learn: For example, senior caregivers told us in interviews that they often approach a younger colleague to tell them to carry out tasks differently. After that, they would give a story about a similar situation in which the approach in question did not work and reflect on both situations with the younger caregiver. Moreover, people may be addressed because they are supposed to support the creation or implementation of a solution—in example 1, reflection was started among nurses to include them in the decision process, and management was involved to implement the change in the procedure. Finally, we also observed partner choice as chance encountering, when the choice of partners resulted from doing certain tasks together or doing similar tasks. In such situations, reassurance on work done was the main purpose of reflection.

Merging our insights on triggers and reflection partners, we find three categories of triggers and related choice of reflection partners:

- **Seeking clarification or resolution:** The category we observed most frequently was an individual seeking input and support by others. This includes triggers such as clarification and seeking help as well as choosing partners based on their experiences or emotional sensitivity.
- **Seeking support for solution implementation:** Reflection partners are often chosen to support the creation or implementation of solutions.
- **Creating awareness:** A subtle category consists of making reflection partners aware of a certain problem or supporting them in learning about it. This was the case with the senior careers reflecting with younger colleagues in care homes, and the head nurse involving the all nurses in reflection.

Reflecting Collaboratively: Looking Inside Collaborative Reflection

Articulation and Perspective Exchange

Collaborative reflection consists of a continuous process of *perspective taking and perspective making* (Boland and Tenkasi 1995): To understand experiences better, the participants exchange their perspectives on the topic reflected, assess their perspectives mutually by looking at the problem from the angle of the respective other and intertwine their views to create a solution. This can be seen in example 1, where nurses exchange their views on how to deal with the emergency alarm, and in example 3 where caregivers discussed different perspectives on how to approach residents who have tough questions. This process, as Boland and Tenkasi (1995) explain, requires from its participants the “ability to take the perspective of another into account”. In the examples, workers did this by evaluating whether the solutions stemming from the perspectives of others could have helped them. In the meeting of caregivers, for example, perspectives had included lying to the resident, avoiding a clear answer by changing the topic, or being honest. In this process of exchanging perspectives, articulation (Suchman 1996) plays a decisive role (Prilla et al. 2012a): Making the rationales behind perspectives and proposed solutions explicit enables reflection participants to take the perspectives of others into account and arrive at a common solution. In example 3, the agreement to be honest to residents was made because one caregiver argued that this would also help the caregivers protect themselves against emotional stress stemming from lying to the residents.

Problem Understanding: Attribution

The shaping of attribution in the sense of “the perception of causality, or the judgement of why a particular incident occurred” (Weiner 1972) plays a decisive role in redesigning work as a result of collaborative reflection. Often, individuals stick to well-known attributions in problematic situations, such as ascribing a problem with using a computer to technical failure. Being able to create attributions based on a better problem understanding enables people create better, more sustainable solutions and thus redesign work. Collaborative reflection, as we observed, helps a group to critically discuss attributions stated by individuals and to shape the attribution of the group to be more elaborate.

In example 1, standard attributions such as blaming a problem to own inabilities or to technical issues did not work for the nurse, and he approached the head nurse. In example 2, the consultants losing pitches had attributed the losses to bad luck or difficult customers—only through a collaborative effort he learned that the real reason was different: when the group collaboratively reflected that they came up with attributions that really made a difference. We observed this shift more clearly

in another example from Case 1: A group of physicians sat together to reflect on recent conversations with relatives, using notes from these talks to explain them to the others. While they explained the problematic situation in these conversations, their colleagues repeatedly stated that they should have stayed calm to avoid the problems—we were told later that this is a standard phrase that clinical educators teach young physicians. In one discussion about a talk in which a relative had become angry with a physician, the group decided not to stick with this simple attribution and found that conflicting statements given to the relatives by different physicians had actually caused the problem.

These examples show how collaborative reflection shapes the understanding of work and how successful reflection can alter work practice by making reflection participants aware of a way to go beyond standard attributions for problems and think more deeply about them.

Perceiving Work: Appraisal of Emotions

Besides understanding rationales behind work, people also need to understand and manage their own emotions and those of others (Hochschild 1979). This is particularly clear in sectors such as healthcare, in which displaying friendliness or empathy is essential in interacting with patients. However, emotions also need to be managed in the interaction with colleagues in collaborative work, as collaborators affect each other emotionally. This happens partially via emotional contagion and partially via *appraisal* of others' emotions (Parkinson and Simons 2009). Appraisal theory (Lazarus and Folkman 1984) states that emotion is about how people perceive situations, and that this perception influences subsequent emotion, and thus further action and interaction. Appraisal thus addresses the cognitive aspect of emotion. Reflection can help learners appraise emotions differently in a similar work situation in the future. As reflection on emotional experience entails re-living the emotions of the experience, reappraisal can also be a part of the reflective process. In example 3, the caregiver had been emotionally affected by the lady, who repeatedly asked whether she would be allowed to go home. During the reflection session, others directly addressed his emotional reaction with their reports and proposal. These perspectives helped the young caregiver to understand why he was affected so much and to change his perception of such situations.

Outcomes of Collaborative Reflection

Levels of Outcomes

Outcomes of reflection can be changes in attitude or perspective, or can be work redesign as we often observed in our case studies. Even if we consider only the outcome of “work redesign”, this may happen at differing levels: Redesign may

affect the work of individuals, teams or entire organizations, and the redesign may concern very precise, fine-granular tasks or very large, only roughly-designed procedures or guidelines for action (such as best practices, or practices originating in organisational culture). In the care home (example 3), the work of the young caregiver was redesigned in that he would approach differently the resident asking him about going home (individual and single task affected) but also the general approach of interacting with residents was changed (group and broad process affected). In the IT company, each consultant learned from the meeting how to better work with clients (individual, task) and, by agreeing to use a demo system, the consultants also changed organisational practice. The nurses agreed to change their training procedure (group, task level) and to ask for changes in the emergency procedure (organisation, process level). This shows how collaborative reflection also affects the *decision for the level of outcomes*: it not only helps the group agree on suitable solutions, but also prevents individuals from focusing solely on individual change and helps them to find an appropriate level of outcomes to sustainably change work practice.

Implementing Solutions

Collaborative reflection also includes dynamics concerning the participants of reflection: Often, solutions on a chosen level cannot be implemented by the participants of a group reflecting and, in order to implement solutions, people have to be included, who have the power, expertise or any other means to put a solution into practice. In our examples the nurses could not change the hospital emergency procedure themselves, which caused them to include management into the process, and the consultants needed to ask other colleagues to create the demo system for them. This is consistent with the finding that one reason for initialising collaborative reflection can be that a person or a group of people is required in order to find a solution at all. On the other hand, to keep up the motivation to critically reflect on own work (Kerth 2001), it is important within collaborative reflection to *also find solutions that the group can implement itself*, as it was the case for the nurses, who could change their training procedures themselves.

Representation of Redesigned Work

The outcomes of reflection can have different levels of formalization: Redesigned work may be expressed or reified in tangible artefacts, e.g., a demo system used by sales people. It may also be expressed in formal or informal rules such as the standard emergency procedure in the process manual of the hospital, or the decision to be honest to residents in the care home, which is an unwritten, informal rule. The results of work redesign may also become manifest in outcomes of work, e.g., increased success rates in sales pitches or better handling of emergencies in a hospital. For all of these targets of change, there is a need to keep track of

consequences stemming from change, that is, whether new artefacts and rules actually create benefit and whether changes in work practice are feasible and effective in the sense of actually supporting work.

Implications: Needs and Challenges for Supporting Collaborative Reflection as Means to Work Redesign

Looking at our insights on reflection as a means of collaborative redesign from the perspective of tool and process support, we identified five major themes: *Connecting sessions* and *sharing and communicating in context* are general themes of collaborative reflection support, while *creating solution teams*, *articulation that talks back* and *linking and awareness* are focused on redesigning work by means of collaborative reflection. These themes describe socio-technical support needs that *complement existing interaction and communication practices*, which, as our examples underpin, need to be in place to make reflection work.

Connecting Sessions

We found that collaborative reflection is an iterative process including *multiple reflection sessions*. Such sessions can be planned or spontaneous, individual or collaborative, and in different iterations, collaborative reflection sessions will have different participants. The alternations between individual and collaborative reflection go beyond an individual briefly reflecting within a collaborative reflection session, and show how individuals consciously switch to collaborative reflection in order to better understand and redesign work practice. Thus, a process of collaborative reflection may be scattered across multiple sessions and adequate support needs to connect reflection sessions, allowing insights to be sustained across sessions and to be related to each other.

Sharing and Communicating in Context

Looking at the motivations to start collaborative reflection as an individual, we found that two major reasons are seeking clarification or resolution and creating awareness—both reasons are based on the need to re-think certain issues together with others with the intention of getting a better understanding of practice. During collaborative reflection, perspective making and taking as well as articulation play major roles, as participants need to engage in communicative interaction on shared experiences. This fits the reasons to start collaborative reflection as described

above. Combining these needs to share and communicate about experiences with the intention to understand them better, tools for supporting collaborative reflection need to create a space for *sharing and communicating* in a context of experiences (see also Boud et al. 2006). There is need to *relate all communication to its context*, that is, the articulations made and experiences documented, allowing people to e.g., comment on documented experiences or criticise attributions of others (Prilla et al. 2012a). One aspect of support can be *finding and addressing reflection partners*, including filters relevant for selecting reflection partners. This need transcends known solutions for finding experts or staff with certain skills in organisations (e.g., Farrell et al. 2007; Reichling et al. 2007): To be an adequate reflection partner may take experience with situations, emotional sensitivity, expertise, power or even a lack in awareness or knowledge.

Creating Solution Teams

More specifically bound to work redesign, we found that collaborative reflection can also be triggered by *seeking support for solution implementation*—individuals are aware that the group of reflection participants needs to include people able to implement changes and thus include these people explicitly. This also holds true for the creation of outcomes from collaborative reflection, as during the creation of outcomes, people may understand which expertise, power or other abilities are needed to implement outcomes. This means that in order to be able to redesign work, there is a need to find and address these experts. Beyond this, this may mean to include them immediately into the reflection process, e.g., by sharing the context of reflection or the group communication with them remotely and immediately in order to ensure follow-up implementation of outcomes. Postponing the inclusion of necessary people after the reflection process can create a barrier caused by extra effort or lacking knowledge of whom to contact.

Learning to Understand Better: Articulation that Talks Back

In the cases, we saw repeatedly that if collaborative reflection is to lead to work redesign, the group should not stick with initial assumptions, beliefs and solutions, but has to seek a better (deeper) understanding of the solution. We found this in the improvement of (individual, simple) attribution and appraisal of emotions that resulted from group reflection sessions, when participants criticized standard or simple attributions and went deeper into understanding a problem such as e.g., why the alarm procedure did not work (Case 1). Similarly, we found that collaborative reflection shapes the level of work redesign: in many cases groups opted for a sustainable, but potentially more effort-demanding solution (e.g., changing the organizational alarm procedure instead of local changes).

The processes of reaching a better understanding by criticizing attributions, commenting emotion appraisal and questioning initial solutions play a decisive role in whether collaborative reflection leads to work redesign. The benefit and feasibility of changes derived from reflection depends on the depth of problem understanding and the associated quality of solution approaches. Going into the necessary depth needs support in which articulations of reflection participants “talk back” (Fischer and Ostwald 2003) to their authors, that is, in which attributions and other proposals are not easily accepted, but critically processed. This can be done, for example, by encouraging other participants to criticize proposals or by reminding people to create a higher level of understanding.

Linking and Awareness

Representations of redesigned work can differ a lot—from digital artefacts (e.g., demo system or process specifications) to being very informal (different attitude “agreed upon” in team). Technology support for redesigning work therefore needs to relate outcomes and their implementation to existing artefacts or rules of an organisation. When work redesign relates to implicit norms (e.g., not lying to residents, example 3), support needs to make people aware of outcomes agreed upon and remind them to take them into account in practice. Both relating to existing artefacts and making people aware might be best done if reflection support is coupled to other systems providing knowledge and supporting learning or communication in an organisation.

Conclusion and Outlook

In this paper, we investigated collaborative reflection, its potential to support iterative processes of bottom-up work redesign, and five themes for technological support for such outcome-oriented collaborative reflection. These findings affect a broad variety of workplaces, as collaborative reflection is an integral work activity at many modern workplaces and as the cases we have analyzed represent a broad bandwidth of different domains and qualification levels among workers.

The importance of collaborative reflection for organizations clearly lies in its power to enable workers to design and implement work changes bottom-up. Such redesign often performed by higher levels in organisations or by external actors such as consultants. Redesign by reflection enables people to gain an understanding of their work practice and create solutions for future work. Their group then makes sure that the solutions have an adequate quality and that they can be implemented. This, however, also creates a shift in power and responsibility that has to be embedded into existing structures and cultures, and in the end needs to be formally permitted and appreciated within the hierarchy of the organization.

Further work will address these issues as well as the implementation and evaluation of the support challenges described in this paper.

Acknowledgments MIRROR is funded under the FP7 of the European Commission (project number 257617). We would like to thank our colleagues for their contributions and valuable input during discussions. Special thanks go to Andrea, Anne, Dominik, Ian, Kevin, Manuel, Malcolm, Samia and Volker for allowing us to gain deep insights into reflection in their respective organisation.

References

- Argyris, C., & Schön, D. A. (1978). *Organizational learning: A theory of action perspective*. Addison-Wesley.
- Baker, D. F. (2010). Enhancing group decision making: An exercise to reduce shared information bias. *Journal of Management Education*, 34(2), 249–279.
- Boland, R. J., & Tenkasi, R. V. (1995). Perspective making and perspective taking in communities of knowing. *Organization Science*, 6(4), 350–372.
- Boud, D., Cressey, P., & Docherty, P. (2006). *Productive reflection at work: Learning for changing organizations*. Routledge.
- Boud, D., Keogh, R., & Walker, D. (1985). Promoting reflection in learning: A model. In D. Boud., R. Keogh, & D. Walker (Eds.) *Reflection: Turning experience into learning* (pp. 18–40). London: Kogan Page.
- Crowston, K., & Kammerer, E. E. (1998). Coordination and collective mind in software requirements development. *IBM Systems Journal*, 37(2), 227–245.
- Daudelin, M. W. (1996). Learning from experience through reflection. *Organizational Dynamics*, 24(3), 36–48.
- Dennis, A. R., George, J. F., Jessup, L. M., Nunamaker Jr, J. F., & Vogel, D. R. (1988). Information technology to support electronic meetings. *MIS Quarterly*, 12(4), 591–624.
- Engeström, Y., Virkkunen, J., Helle, M., Pihlaja, J., & Poikela, R. (1996). The change laboratory as a tool for transforming work. *Life Long Learning in Europe*, 2(2), 10–17.
- Eraut, M. (2004). Informal learning in the workplace. *Studies in Continuing Education*, 26(2), 247–273.
- Farrell, S., Lau, T., Wilcox E., Nusser, S., & Muller, M. (2007). Socially augmenting employee profiles with people-tagging. In: *Proceedings of UIST* (pp. 91–100). New York: ACM.
- Fischer, G., & Ostwald, J. (2003). Knowledge communication in design communities. In: R. Bromme, F. Hesse, & H. Spada (eds.) *Barriers and biases in computer-mediated knowledge communication* (pp 213–242). Dordrecht: Kluwer Academic Publishers.
- Gray, P., Johansen, B., Nunamaker, J., Rodman, J., & Wagner, G.R. (2011). GDSS past, present, and future. In D. Schuff (Ed.) *Decision support* (pp. 1–24) Dordrecht, Heidelberg, London New York: Springer.
- Hochschild, A. R. (1979). Emotion work, feeling rules, and social structure. *American Journal of Sociology*, 85(3), 551–575.
- Hoyrup, S. (2004). Reflection as a core process in organisational learning. *Journal of Workplace Learning*, 16(8), 442–454.
- Kerth, N.L. (2001). *Project retrospectives*. Dorset House.
- Kimmerle, J., Cress, U., & Held, C. (2010). The interplay between individual and collective knowledge: Technologies for organisational learning and knowledge building. *Knowledge Management Research & Practice*, 8(1), 33–44.

- Knipfer, K., Prilla, M., Cress, U., & Herrmann, T. (2011). Computer support for collaborative reflection on captured teamwork data. In: *Proceedings of the 9th International Conference on Computer Supported Collaborative Learning* (pp. 938–939).
- Kolb, D.A., & Fry, R. (1975). Towards an applied theory of experiential learning. In C. Cooper (Ed.) *Theories of group processes* (pp. 33–58). London: Wiley.
- Krogstie, B., Prilla, M., Wessel, D., Knipfer, K. & Divitini, M. (2012). Computer support for reflective learning in the workplace: A model. In: *Proceedings of the 2012 IEEE International Conference on Advanced Learning Technologies (ICALT 2012)*.
- Lazarus, R.S., & Folkman, S. (1984): *Stress, appraisal, and coping*. Springer.
- Parkinson, B., & Simons, G. (2009). Affecting others: Social appraisal and emotion contagion in everyday decision making. *Personality and Social Psychology Bulletin*, 35(8), 1071–1084.
- Power, D.J., & Sharda, R. (2009). Decision support systems. In *Springer handbook of automation* (pp. 1539–1548). Springer.
- Prilla, M., Degeling, M., & Herrmann, T. (2012a). Collaborative reflection at work: supporting informal learning at a healthcare workplace. In: T. Finholt, H. Tellioglu, K. Inkpen, & T. Gross (Eds.) *Proceedings of the ACM International Conference on Supporting Group Work (GROUP 2012)* (pp. 55–64).
- Prilla, M., Pammer, V., & Balzert, S. (2012b). The push and pull of reflection in workplace learning: Designing to support transitions between individual, collaborative and organisational learning. In A. Ravenscroft, S.N. Lindstaedt, C.D. Kloos, & D.H. Leo (Eds.) *Proceedings of the 7th European Conference on Technology Enhanced Learning* (pp. 278–291).
- Reichling, T., Veith, M., & Wulf, V. (2007). Expert recommender: Designing for a network organization. *Computer Supported Cooperative Work*, 16(4), 431–465.
- Reynolds, M. (1999). Critical reflection and management education: rehabilitating less hierarchical approaches. *Journal of Management Education*, 23(5), 537–553.
- Roschelle, J., & Teasley, S. (1995). The construction of shared knowledge in collaborative problem solving. In: *Computer supported collaborative learning* (pp. 69–97). Heidelberg: Springer.
- Schön, D. A. (1983). *The reflective practitioner*. New York: Basic Books.
- Stahl, G. (2000). A model of collaborative knowledge-building. In: *Proceedings of ICLS 2000* (pp. 70–77). Ann Arbor: Lawrence Erlbaum.
- Strauss, A.L., & Corbin, J.M. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Sage Publications.
- Suchman, L. (1996). Supporting articulation work. In R. Kling (Ed.) *Computerization and controversy: Value conflicts and social choices* (pp. 407–423).
- Sykes, R. E. (1983). Initial interaction between strangers and acquaintances— A multivariate analysis of factors affecting choice of communication partners. *Human Communication Research*, 10(1), 27–53.
- Van Woerkom, M., & Croon, M. (2008). Operationalising critically reflective work behaviour. *Personnel Review*, 37(3), 317–331.
- Weick, K.E. (1995). *Sensemaking in organizations*. Sage Publications.
- Weick, K.E., & Roberts, K.H. (1993). Collective mind in organizations: Heedful interrelating on flight decks. *Administrative science quarterly*, 357–381.
- Weiner, B. (1972). Attribution theory, achievement motivation, and the educational process. *Review of Educational Research*, 42(2), 203–215.